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MASTER OF SURGERY

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A STUDY OF OCULAR MANIFESTATIONS IN

ANAEMIC PATIENTS

DR. PATEL SHIVANG DASHRATHBHAI

SANTOSH DEEMED TO BE UNIVERSITY
NO. 1, SANTOSH NAGAR,
GHAZIABAD-201009, NCR DELHI, INDIA

DEPARTMENT OF OPHTHALMOLOGY
SANTOSH MEDICAL COLLEGE & HOSPITAL
GHAZIABAD, NCR DELHI

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Guide

Dr**. SHIKHA PAWAIYA**
Associate Professor
Department of Ophthalmology
Santosh Medical College & Hospital
Ghaziabad (U.P.), India

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Co-Guide

Dr. SARITA AGGARWAL
H.O.D. & PROFESSOR
Department of Ophthalmology
Santosh Medical College & Hospital
Ghaziabad (UP), India

CERTIFICATE BY THE CO-GUIDE

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Co-Guide

DR. SHIVANI BANSAL
PROFESSOR
Department of Medicine
Santosh Medical College & Hospital
Ghaziabad (UP), India

CERTIFICATE BY THE HEAD OF THE DEPARTMENT

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PROF. (Dr.) SARITA AGGARWAL
M.B.B.S., M.S.
Professor & Head
Department of OPHTHALMOLOGY
Santosh Medical College & Hospital
Ghaziabad – 201001 (U.P.)

SANTOSH
Deemed to be University
(Established u/s 3 of the UGC Act, 1956)

ENDORSEMENT BY THE DEAN OF THE COLLEGE

This is to certify that the thesis titled**"STUDY OF OCULAR MANIFESTATIONS IN ANAEMIC PATIENTS"**is a bonafide research work carried out by **Dr. PATEL SHIVANG DASHRATHBHAI** under the esteemed guidance of **Dr. SHIKHA PAWAIYA** Santosh Medical college and is presented before the ethical committee of Santosh University, Ghaziabad for requisite approval.

Dr Alka Agrawal

Dean
Faculty of Medical Sciences
Santosh Medical College & Hospital
Santosh Deemed to be University
Ghaziabad – 201001 (U.P.)

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Abbreviations

CBC:	Complete Blood count
Hb:	Haemoglobin
microL:	Microlitre
O2:	Oxygen
RBCs:	Red Blood Cells
RBS:	Reandom Blood Sugar
VEGF:	Vascular Endothelial Growth Factor
WHO:	World Health Organisation
BP:	Blood Pressure

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Introduction

There are many different types of diseases that can appear as haematological disorders and have ocular symptoms. One of the most prevalent haematological disorders, anaemia can appear with a wide range of ocular abnormalities.[1,2]

Every component of the eye is susceptible to anaemia. Conjunctival pallor and retinal abnormalities such as venous tortuosity, cotton wool spots, retinal haemorrhages, posterior pole pallor, papilledema, macular haemorrhages, Roth's spots, macular star, and subconjunctival haemorrhages have been shown in previous studies to be the important manifestations seen in anaemic patients.[2-5]

Anemia impairs the vital nutritional supply necessary for retinal metabolism, which puts the retina at risk of hypoxic damage. In the l9th century, retinal exudates and haemorrhages were identified in patients with blood diseases. All eye structures, including the eye's adenexa, can exhibit anaemia and other haematologic disorders (lid edema).[1,6,7]

A low level of healthy red blood cells (RBCs) or haemoglobin (an iron-binding, oxygen-carrying protein within RBCs), which is a component of RBCs, can result in anaemia. Anemia can be categorised in the following ways depending on the cause:[6]

• Hypo-proliferative:

Caused by inadequate bone marrow RBC production.[6]

• Haemolytic:

Caused by increased bleeding or red blood cell injury.[6]

• Ineffective erythropoiesis:

Brought on by anomalies in the blood cell's synthesis.[6]

The most prevalent type of anaemia is nutritional anaemia, which results from iron deficiency. Pernicious anaemia, which results from a vitamin Bl2 shortage, is another type of

nutritional anaemia. Ulrich initially identified transitory retinal haemorrhages in the eye in l883. Anemia can cause them.[8]

In 28% of individuals, anaemia results in retinopathy, particularly when thrombocytopenia (38%), is also present. The risk of retinopathy rises as anaemia severity rises, especially when haemoglobin (Hb) levels are below 6 gm/dl.[8]

The clinical characteristics of anaemic retinopathy are thought to be caused by a range of pathologic alterations that are brought on by and linked to anaemia.[8]

Cotton wool patches are a clinical symptom of retinal hypoxia, which anaemia induces to trigger nerve fibre layer infarction. Additionally, retinal hypoxia causes microtraumas to the artery walls, which result in retinal edoema and haemorrhages, vascular dilatation, increased transmural pressure due to hypoproteinemia, and transmural pressure.[8]

Anemia and thrombocytopenia frequently coexist in clinical settings, which can result in haemorrhages and abnormal coagulation.[8]

Thrombocytopenia frequently co-occurs with anaemia in clinical settings, and other variables such venous stasis, angiospasm, increased blood viscosity (myeloproliferative diseases), hypotension (after haemorrhage), etc. may also contribute to the pathology. Optic neuropathy may be brought on by hypotension.[8]

Aim and Objectives

Following is my aim of the study

- To study ocular manifestations in patients with anaemia.

Following are my objectives of the study

- To study the ocular manifestations in patients with anaemia.
- To compare severity of anaemia with ocular manifestation in anaemic patients.
- To study ocular manifestations in patients of anaemia with thrombocytopenia.
- To compare the occurrence of retinal manifestations in patients with anaemia with thrombocytopenia vs anaemia.

Review Of literature

Every component of the eye is susceptible to anaemia. Conjunctival pallor and retinal abnormalities such as venous tortuosity, cotton wool spots, retinal haemorrhages, posterior pole pallor, papilledema, macular haemorrhages, Roth's spots, macular star, and subconjunctival haemorrhages have been shown in previous studies to be the important manifestations seen in anaemic patients.[2-5]

- IN 2022 KHUlUQI, Rofa Husnul et al conducted study to describe the clinical results of retinopathy caused by autoimmune hemolytic anaemia (AIHA) and their quick recovery after steroid treatment. Retinopathy may develop as a result of anaemia. By connecting ophthalmic findings with a positive serological test, retinopathy can be diagnosed. A thorough examination can accurately determine the systemic diagnosis, and managing the systemic parameters will improve retinopathy, reverse vision loss, and avoid permanent blindness.[9]

- In 202lFM Monjur Hasan et al conducted study on Demographic Profile & Correlation between Retinal Hemorrhages and Hematological Parameters in leukemic Patients. Anemia is more likely to develop in leukaemia patients. Fundal lesions were found in 32 of 50 leukemic patients (64%) with retinal haemorrhages being the most prevalent lesion (90.63%). The majority of haemorrhages, 25 (86.2%) had flame-shaped haemorrhages, while 4 (l3.8%) had white haemorrhages in the centre. The majority of patients with acute lymphoblastic leukaemia (All) and acute myeloid leukaemia (AMl), 48.28% and 5l.28%, respectively, had haemorrhage. Patients with chronic lymphocytic leukaemia (Cll) and chronic myeloid leukaemia (CMl), with haemorrhage rates of 38.l0% and 28.57%, respectively, were less likely to experience it. In light of this, haemorrhages were more common in acute than in chronic leukaemia (p 0.00l).Retinal haemorrhages and thrombocytopenia were significantly linked (p 0.00l). The fundal haemorrhages did not statistically significantly correlate with either a high white cell count (p=0.25) or a low haemoglobin level (p=0.08). According to this study, patients with leukaemia

frequently experience retinopathy. Therefore, when treating leukemic patients, adequate attention should be given to fundoscopic evaluation.[10]

- In 2020 Kumar J et al conducted study on Ophthalmic Manifestations of Anemia. This prospective study involved l50 patients who had anaemia from any causes. In l25 out of l50 cases (83.33%) of anaemia, conjunctival pallor was the most prevalent ocular sign. In 35 of l50 cases (23.33%), retinal abnormalities were the second most prevalent ocular manifestation. The third most frequent ocular sign, which was present in 25 patients out of l50 (l6.67%), was posterior pole pallor. 45 cases (30%) were under l5 years old, while l05 cases (70%) were older. There were 82 (54.67%) female cases and 68 (45.33%) male cases. Of the admitted cases, 66 (44%) had severe anaemia, 63 (42%) moderate anaemia, and 21 (l4%) mild anaemia. Most patients with severe grade (6g/dl) anaemia had retinal abnormalities. Even before haematological reports can confirm the presence of anaemia, the fundus provides a picture of the arteries and veins and can therefore provide crucial diagnostic hints in cases of anaemia. Therefore, in all cases of suspected as well as confirmed anaemia, fundus examination should be a part of the crucial routine examination.[11]

- In 20l9 Ajay Kumar et al conducted An Evaluation of Ocular Manifestations in Patients with Anemia: A Prospective Cross-Sectional Study. Out of l20 patients, conjunctival pallor was the most frequently found condition (93.3%). Out of l20 patients, 34.l% experienced superficial retinal haemorrhages. In (29.l%), deep retinal haemorrhages occur. Out of l20 patients, 46.6% had posterior pole pallor. Patients with severe anaemia and thrombocytopenia have a higher incidence of retinopathy. Numerous ocular manifestations can result from anaemia. Patients who have conjunctival pallor should have their anaemia checked. A fundus examination should be performed on patients with moderate to severe anaemia because this condition may be linked to anaemic retinopathy. The severity of anaemia determines how severe retinal haemorrhages are. Early anaemia treatment and subsequent resolution of retinal haemorrhages are made possible by early detection of anaemic retinopathy.[12]

- In 20l7 Pragati Garg et al conducted a study on Occular Manifestations in Anemic Patients. Study participants included 294 anaemic patients. Diminished vision was the third most frequent ocular symptom, occurring in 28.9l% of cases. Whether it was the

loss of vision, lid oedema, subconjunctival haemorrhage, disc pallor, retinal haemorrhage, or vascular alterations and macular oedema, the results were highly significant (p 0.00l). Every moderate to very severe anaemic patient should have their ocular symptoms thoroughly evaluated. An obligatory fundus examination should be performed on the patient to detect anaemic retinopathy.[13]

- In 20l7 Recent research suggests that the superficial and deep capillary plexi, with a preference for the deep capillary plexus, may be both affected by macular perfusion abnormalities seen in sickle cell disease patients of various genotypes. These changes may be linked to areas of macular thinning as well as peripheral retinal ischemia, even in people who do not have visual symptoms. Additionally, a number of cases point to paracentral acute middle maculopathy as a potential pathophysiologic mechanism for how microvascular occlusion causes macular thinning.[14]

- In 20l4 AM Mansour et al conducted retrospective study for ophthalmic manifestations in aplastic anemia atients. A total of 7l9 patients received care; 269 gone through eye exams, l56 gone through retinal assessments, and 37 (23.7%) have retinal findings. With mean haemoglobin of 6.6 g/dl (range 2.7-l2.6 g/dl) and platelet counts of l8.8 l09/l (range 4-l57 l09/l), these 37 patients had unilateral retinal haemorrhage in seven and bilateral retinal haemorrhage in 30. They also had central retinal vein occlusion-like pictures in 9 patients, and these had similar rheology to the other subjects. Additionally, they had optic disc edoema, Systemic bleeding occurred in 24.8%, retinal haemorrhage in 37%, and any bleeding site (eye or elsewhere) in 47.5% of the l4l subjects with AA in this Korean study. Ophthalmologists may be the first medical professionals to diagnose AA, a rare condition that is potentially blinding if not treated quickly.[15]

- In 20l4 Satish C. Shitole et al conducted a study on patients with anemia for ocular manifestations. The subjects of the study were adult anaemic patients. According to the study, anaemia can cause a wide range of ocular manifestations, so anyone experiencing conjunctival pallor should have their anaemia checked. They also came to the conclusion that patients with moderate to severe anaemia should have a mandatory fund examination because anaemic retinopathy occurs more frequently in

these patients than it does in those with mild anaemia. Early detection, and early retinopathy resolution is aided by the initiation of treatment for underlying anaemia.[2]

- In 20l4 C. Seema et al conducted a cross sectional study on anemic patients to find out retinal manifestations. After data analysis, it was discovered that retinal Significant numbers of patients, particularly those with severe anaemia, had abnormalities. The most frequent retinal finding was an optical disc pallor, which was followed by roth spots and flame-shaped superficial haemorrhages.[3]

- In 20ll, Suresh Kalpana et al conducted a non-interventional prospective study to see various ocular manifestations in patients with haematological disorders. According to research, nutritional anaemia is the most prevalent abnormality in the hemology. The most frequent manifestation of retinal haemorrhages, according to the study, are those in the shape of flames. Retinal haemorrhages are more likely to occur when platelet counts are low and anaemia is present.[4]

- Shaheen N et al conducted study in patients diagnosed with various diseases presented with anaemia to study the various ocular manifestations of anemia and relation of these manifestations with severity of anemia. According to research, conjunctival pallor was the most common characteristic.The second most frequent manifestation was ocular manifestation, followed by abnormalities of the retina. The third most typical symptom was posterior pole pallor. The study also found that patients with anaemia and associated thrombocytopenia had an increased incidence of retinal abnormalities (retinal haemorrhages).[5]

- Consett JE et al conducted study, Anemia in Indian patients revealed that retinal haemorrhages were uncommon in cases of anaemia caused by blood loss and iron deficiency, but nearly always occurred in patients with severe megaloblastic anaemia. The study also showed that patients with concomitant thrombocytopenia had a higher incidence of retinal haemorrhages.[16]

- Holt JM et al conducted a study Patients with severe hypochromic or blood loss anaemia as well as pernicious anaemia frequently experienced ocular haemorrhages. The study also revealed that cotton wool patches appeared in l5% of cases, however

other than showing the severity of anaemia, these spots had no distinctive significance.[17]

- Gaurav Y. Shah et al conducted study that Depending on the origin of the anaemia, clinical symptoms change. When the number of healthy red blood cells (RBCs) or haemoglobin (an iron-binding, oxygen-carrying protein within RBCs), which is a sign of anaemia, is too low, anemias develop. Anemias can be categorised as follows based on the cause: erythropoiesis that is hemolytic, hypoproliferative or ineffective erythropoesis. They came to the conclusion that the most prevalent form of anaemia is iron deficiency. In addition to the changes that occur in all types of anemias, such as retinal haemorrhages, soft & hard exudates, retinal edoema, vascular alterations, etc., it may be linked with central retinal vein occlusion, retinal artery occlusion, disc edoema, and anterior ischemic optic neuropathy. They emphasised that the characteristics of anemias will vary depending on their origin. Anemia caused by a vitamin Bl2 deficiency can result in optic neuropathy, which is visible as disc pallor. Due to vaso-occlusion caused by sickle cell anaemia, the retina develops proliferative alterations that might result in vitreous haemorrhage and retinal detachment. Red blood cell sickling can result in choroidal infarcts. It's noteworthy to observe that this condition causes patches of iris atrophy and neovascularization as well as the conjunctival sickling sign. Roth spots, leukemic infiltrates in the retina, choroidal infiltration with secondary serous retinal detachment, microaneurysms, and vascular sheathing may all be present in myeloproliferative diseases. Retinal pigment epithelium alterations have been linked to thalassemic changes.[l8]

- Ahmad M Mansour Conducted study that The most frequent ocular finding is retinal haemorrhage, which in one group affected 23.7% of individuals with aplastic anaemia. The second most common result, appearing in 5.8% of patients, is a central retinal vein occlusion-like image; its frequency does not appear to be linked to a more severe rheology. The intensity and co-existence of anaemia and thrombocytopenia are related to the incidence of ocular abnormalities in patients with aplastic anaemia. Small preretinal haemorrhages can be treated with blood transfusions, but major haemorrhages need vitrectomy or posterior hyaloidotomy to avoid irreversible macular damage. To avoid ocular morbidity, patients should be counselled to stay

away from Valsalva movements, rubbing their eyes, and strenuous exercise. If untreated, aplastic anaemia poses a risk for blindness and could result in death.[19]

- Sherrol A. et al conducted study that Hematological diseases cover a broad range of illnesses, from benign to malignant problems, such as red blood cell abnormalities such different anemias, platelet disorders, and haematological cancers that can affect the eyes. The first sign of an underlying haematological illness may be ocular symptoms. When the amount of healthy red blood cells (RBCs/erythrocytes) or haemoglobin (the iron-binding, oxygen-carrying protein) falls below normal, a disease known as anaemia develops. Haemolytic anaemia, increased blood loss, and insufficient RB generation by the bone marrow are all factors contributing to anaemia (aplastic anemia). Deficits in folic acid, iron, or vitamin Bl2 (pernicious anaemia) can also result from inadequate nutrition or gastrointestinal absorption disorders.[20]

- Yahia SB An individual with Fanconi anaemia who presented with complaints of right eye pain and neovascular glaucoma, or vitreous haemorrhage, all of which can cause severe vision loss. Regular examination to be done in such cases to prevent further complications.redness. The results of the right eye examination included peripheral retinal neovascularization and areas of capillary non-perfusion on fundus examination, while the results of the left eye examination included neovascular glaucoma, vitreous haemorrhage, optic disc neovascularization, and features of peripheral ischemic retinopathy. This case report provides evidence that people with Fanconi anaemia may experience retinal or ocular neovascularization. [21]

- Biousse V et al, Anaemia may be a factor in the development of elevated ICP and papilledema, according to an interventional case series that was conducted to clarify the connection between the two conditions. It was advised to acquire a complete blood count in patients with suspected elevated ICP since the majority of people are not known to be anaemic when papilledema is identified, particularly when no recognised variables like obesity or drugs like oral contraceptive pills are present. Although the underlying causes of anaemia with elevated ICP are unknown, cerebral venous thrombosis needs to be carefully ruled out. [22]

MATERIAlS AND METHODOlOGY

Materials

Study Setting: Department of Ophthalmology, Santosh Medical College and Hospital, Ghaziabad.

Study Frame: OPD (OutPatient Department) Ophthalmology, SantoshHospital.

Study Unit: Patients with anaemia between l8 to 60 years.

Study Design: Cross Sectional Observational Study.

Sample Size: l00 patients fulfilling the criteria of inclusion and exclusion were taken for study.

$$n = \frac{Z^2_{l-\frac{\alpha}{2}}}{e^2}$$

$Z^2_{l-\alpha}$ =l.96 at 5% level of significance

e= incidence rate (2l%)

n=87

INCIUSION CRITERIA:

1. Diagnosed cases of Anaemia satisfying the WHO criteria.
2. Age between l8 to 50 years.

EXCIUSION CRITERIA:

1. Patient diagnosed with Diabetes mellitus.
2. Patient diagnosed with hypertension.
3. Patient with dense media opacities.
4. Patients with any pre existing retinal pathology.

Statistical Analysis:

Data was manually collected, entered into an MS Windows Excel spreadsheet, and then properly analysed using online Graph Pad software using cross tabulation, frequency graphs, histograms, means, medians, standard deviations, Pearson correlation coefficients, parametric and non-parametric tests, among other standard statistical methods.

Methodology

The current examination was carried out at Santosh Medical College & Hospital in Ghaziabad's Outpatient Ophthalmology department. Once all subjects had given their written informed consent and had been told of the significance of eyesight, the subjects were all enrolled in the study. Patients were examined methodically and systematically with the assistance of the OPD staff.

Outpatient and inpatient at Santosh Medical College and Hospital, diagnosed with anaemia, were taken for study.

WHO grading based on haemoglobin levels was used to categorized patients.

Table: 1 WHO grading of anaemia.

	FEMALE		**MALE**
	Non pregnant	**Pregnant**	
Non anaemic	>11.9 g/dl	>10.9 g/dl	>12.9 g/dl
Mild	11-11.9 g/dl	10-10.9 g/dl	11-12.9 g/dl
Moderate	8-10.9 g/dl	7-9.9 g/dl	8-10.9 g/dl
Severe	<8 g/dl	<7 g/dl	<8 g/dl

After taking informed written consent demographic details, ocular complaints if any, past history, personal history, family history taken, general physical examination and systemic examination done.

Each patient was subjected to detailed history taking, followed by –

- External ocular examination.
- Visual acuity for near and distance using Snellen’s chart.
- Slit lamp examination.

- Intraocular pressure measurement using Goldman's applanation tonometry (GAT).
- Fundoscopy using direct ophthalmoscope and indirect ophthalmoscope.

Best corrected visual acuity Assesment:

Snellen's visual acuity chart, which accesses distant central visual acuity, is used to test visual acuity in patients.[23]

Two things can appear to be two different objects when they are situated far apart and subtend at an angle of one minute at the nodal point of the eye. The Snellen test forms are built on top of this principle.[23]

It has a series of black capital letters on a white board placed in a row that gradually get smaller in size as one moves from top to bottom of a chart.[23]

An evaluation of visual acuity was conducted at a distance of 6 metres.[23]

Patients were presented the Snellen chart, where the first line was 6/60 and the last line was 6/6, and asked to read the alphabets from first to last line with each eye separately.[23]

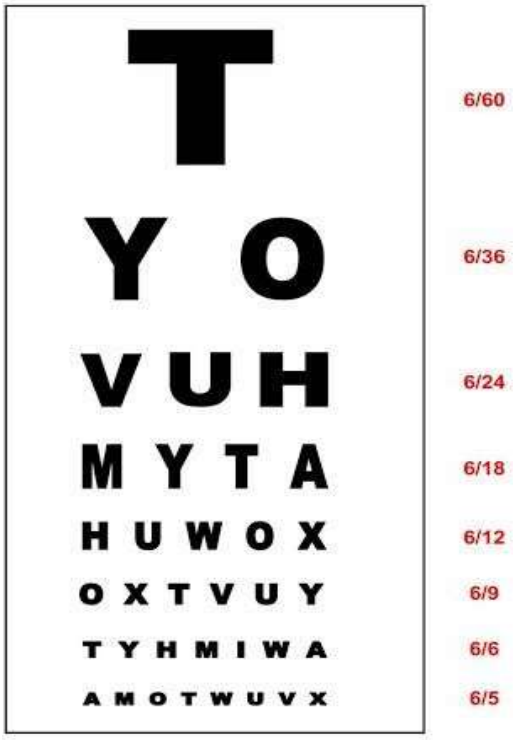
The patient was instructed to approach the Snellen map slowly in order to read the uppermost line if they were unable to see the first line (6/60) from a distance of 6 metres. Otherwise, their vision was recorded as 5/60, 4/60, 3/60, 2/60, and l/60.[23]

If the patient was unable to see the first row at a distance of one meter, they were instructed to count the interviewer's fingers close to their face. The acuity was then recorded as CF3', CF2', CFl' OR CF- close to the face depending on how far they could count the fingers. [23]

If Patient can't do finger counting waving hand gesture done close to the face. The acuity than labeled as HMCF (hand movement closed to face).[23]

. Examiner observed whether or not they could appreciate light (Pl) if they were unable to understand hand movements. If so, the vision was recorded as Pl Positive; otherwise, it was recorded as Pl Negative.[23]

Patients below visual acuity 6/6 were under gone spectacular correction. Best corrected visual acuity noted as vision of a patient.



Picturel: Snellen's chart for visual acuity assessment.[23]

Ocular examination diffuse torch light:

All patients underwent a diffuse torch light examination of the ocular adnexa, which included checking for any obvious abnormalities in the cornea, conjunctiva, anterior chamber, iris, and pupil as well as the head position, facial symmetry, eyebrows, eyelashes, and eyelids.[25]

Slit lamp examination biomicroscopy:

Slit lamp biomicroscopy was used to thoroughly evaluate the anterior and posterior segments of each group and look for any signs of ocular morbidity. Allvar Gullstrand, an ophthalmologist and l9ll Nobel laureate, invented the slit light. later, Hecker and Vogt modified the Gullstrand and Czapski microscope to create an adjustable microscope.[26]

The 3D view of the eye is possible with a contemporary slit lamp biomicroscope. It is an effective stereoscopic diagnostic device. It centers mostly on the illumination and observation systems. Magnification levels range from 5x, l0x, l6x,40x to l00x. Slit lamps produce an upright, virtual image.[26]

Picture:2 Slit lamp Examination

Following proper patient posture on the slit lamp, a thorough examination is conducted as shown below.

Examination of eyebrows was done for the level and any Cilia abnormalities. Eyelashes, lid margins, and skin above the lids are all checked for any abnormalities in their position and movement. Palpebral aperture was examined for any unusually wide, tall, or shaped openings. For any irregularity in the puncta and lacrimal sac region, use the lacrimal apparatus.

Conjunctiva examined the palpebral, bulbar, and fornix parts for any anomalies. The size, shape, surface, curvature, transparency, and sensation of the cornea are all checked for any abnormalities, if there is any corneal vascularization. Fluorescein staining is performed in suspected cases. The back of the cornea was examined for pigmentation and keratic precipitates. limbus and Sclera searched for any abnormalities, including ectasia, nodules, and discolouration.Any abnormalities in the depth of the anterior chamber, as well as any aberrant contents like blood (hyphema), pus (Hypopyon) etc.

Iris was inspected to look for any abnormalities in its pattern and colour. Synechiae, iridodonesis, iris nodules, neovascularization of the iris, and iris cysts should all be recognised if present. The pupil examined for any anomalies in its size, shape, or location. Direct, indirect, or consensual pupillary reflexes as well as swinging flesh light and a near reflex are all assessed. The position, shape, colour, and transparency of the lens are all checked for any abnormalities. Both the quantity of purkinje images formed and any deposits on the anterior lens surface were noted. the anterior vitreous phase examined the contents for any abnormalities (blood in case of vitreous hemorrhage).

Intra ocular pressure of every patients were measured using Goldman's applanation tonometer and corrected according central corneal thickness before dilating pupil of patient.

Before fundus examination dilatation of pupil done by combination 0.8% tropicamide and 5% phenylephrine, 3 drops l0 mins apart in both eyes.

Fundus examination was performed utilising a 90D slit lamp biomicroscope where the created picture was real and inverted. If professionals only have room for one lens, the 78D with 0.77x magnification is typically a versatile all-around lens. Another choice is the 90D (0.64x), which is also a suitable all-purpose lens Since the 60D lens delivers a higher magnification of about lx, it is especially well suited for disc imaging. Additionally, because of the unit magnification, there is no conversion needed to determine the size of the disc. If you need higher magnification or prefer a longer working distance, the 20D and 28D lenses are perfect.

These lenses are preferred when patients can't use a slit lamp, when youngsters need a panoramic view yet have short viewing times, when imaging is difficult due to nystagmus, or when scleral indentation is necessary.

Picture:3 Slit lamp Biomicroscopy with 90D

Fundus examination with Direct and Indirect Ophthalmoscope:

Ophthalmoscopy is a clinical examination procedure that uses an ophthalmoscope to examine the interior of the eye. In routine practise, it is done to view the fundus of the eye, assess the disc, retina, and macula's condition, as well as to find any opacity of ocular media. Both direct and indirect ophthalmoscopes are designed to perform ophthalmoscopy.[24]

Herman von Helmholtz created the Direct Ophthalmoscope for the first time in l85l. It is a uniocular ophthalmoscope that comes equipped with a variety of lenses. It displays a virtual and upright image with a l5-fold magnification. It has l0 degree fiels of viw. There is no stereopsis, and any haze makes it challenging for the examiner to look at the fundus.[26]

Charles Schepens initially introduced the indirect ophthalmoscope, a binocular variation of the ophthalmoscope, in l945. To see the fundus, you need a 20D condensing lens. The retina and eye lens are aligned along the same primary axis, and the picture generation is actual, inverted, and magnified by two to five times while being held at arm's length. It needs a strong source of illumination. There is stereopsisis present, and the field of focus extends up to 8 discdimeters, or to the ora serrata (peripheral retina). In contrast to a direct ophthalmoscope, examination through a cloudy medium is also possible with an indirect one.[26]

Picture: 4 Direct Ophthalmoscopy

Picture:5 Indirect Ophthalmoscopy

All age groups had a fundus examination using a binocular indirect ophthalmoscope (Welch Allyn l25 model) and a direct ophthalmoscope (Heine Beta 200-S model), with the following considerations used when completing the examination.

Any opacity in the ocular media, such as corneal, lenticular, and vitreous (exudates, haemorrhage, foreign body, and vitreous membranes) opacities, was recorded.

Examination of the optic disc for any deviations in its colour, shape, size (diameter), margin, and C/D ratio (Cup disc ratio).We looked for any deviation from the typical 4:l6 ratio of large to small blood veins on the disc. If present, identify any further abnormalities such as splinter haemorrhages, neovascularization, or opto-ciliary shunt.

Examining of the macula done for any abnormalities such as fundus pallor, macular oedema, cherry red patch, or macular scarring as well as the foveal reflex noted. Any anomalies in the retinal vasculature, such as arteriole constriction, vein tortuosity, or vessel sheathing, are observed. If present, arterial and venous pulsations were detected. Rest retinal examination done and if any abnormality present like flame shape haemorrhages, dot and blot haemorrhages, cotton wool spots etc were noted.

The retina is a 266 mm^2 surface area layer of sensitive, thin nerve tissue. The optic disc, retinal blood vessels, area centralis with the fovea and foveola, peripheral retina containing the equator, and ora serrata are the retina's principal structural elements. A pigmented layer and a sensory layer make up the retina. The optic disc is where the retina is the thickest, measuring around 0.56mm. The thickness decreases as it moves away from the centre, dropping to 0.l mm at the ora serrata and 0.l8 mm at the equator.

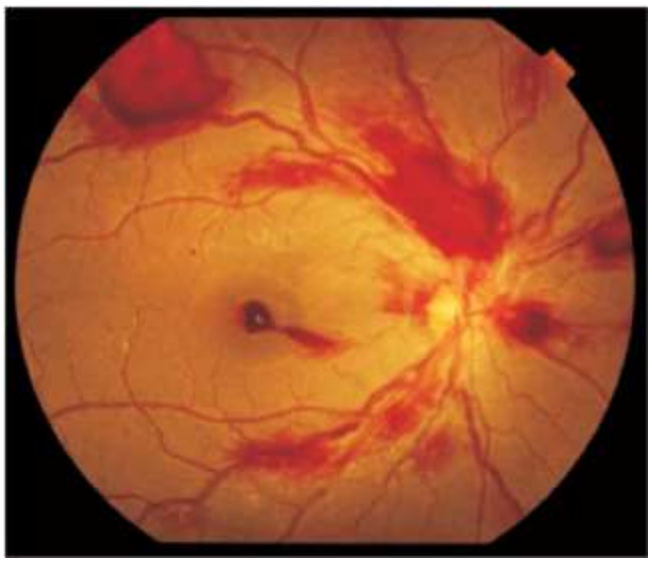
Following ocular manifestation due to anaemia were noted[1-3]

- **Conjuctival Pallor:**

  It is noted at palpebral conjunctiva.Of all anemias, it has the most widespread ocular manifestation. It can be accompanied by **subconjunctival haemorrhage** and **lid oedema**, particularly when anaemia and thrombocytopenia coexist.

- **Retinal haemorrhages:**

  Picture: 6 Retinal Haemorrhages



The development of superficial flame-shaped haemorrhages in the retinal nerve fibre layer is the most common retinal manifestation in the majority of anemias.

In a small number of individuals, dot and blot haemorrhages in the deeper retinal layers can also be observed. The sub-hyaloid plane can occasionally contain bleeding in the form of sub-hyaloid haemorrhage. There may also be vitreous haemorrhage.

Roth spots, a retinal haemorrhage with a white centre, could be detected. Neoplastic cells, fibrin and platelets, inflammatory infiltrates, isolated areas of ischemia, and neoplastic cells can all cause the white centres of Roth spots.

These characteristics are more prevalent in people who also have thrombocytopenia and anaemia.

- **Cotton wool spots:**

Picture: 7 cotton wool spots

In patients who are anaemic, these superficial, fluffy white lesions are present.

Because of retinal ischaemia and hypoxia, lesions form on the retina's nerve fibre layer.

- **Retinal oedema:**

  Blood leaks through the vessel wall as a result of increased pressure there and damage to the vessel walls.
  A buildup of this blood in the sub-retinal spaces may cause retinal edoema, which may then result in retinal detachment.

- **Hard exudates:**

  These can occur in people who have chronic anaemia and are brought on by retinal haemorrhages that have healed. Macular star is visible when these are bad and are near the macula.

- **Vascular Changes:**

  With severe anemias, these observations are more frequently observed.
  Anemia can result in venule dilatation, venule tortuosity, and arteriolar attenuation.

- **Optic nerve changes:**

  Patients with moderate to severe anaemia may have ocular disc pallor and edoema. Patients who have severe anaemia may develop optic neuropathy.

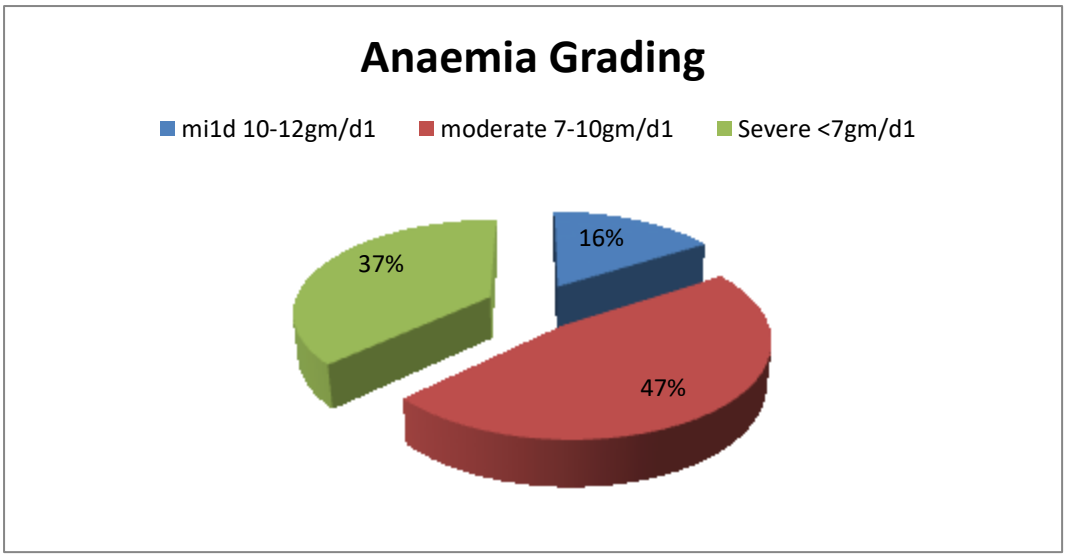
Resu1ts

In this c1inical cross sectiona1 prospective study, 100 diagnosed anaemic patients with or without associated thrombocytopenia were taken. Among those 100 patients 16 patients (16%) had mi1d anaemia, 47 patients (47%) had moderate anaemia, 37 patients (37%) had severe anaemia.

Tab1e: 2 According to the grading of anaemia distribution of the patients

Grade	mi1d	moderate	Severe
Haemog1obin	10-12gm/d1	7-10gm/d1	<7gm/d1
Patients	16	47	37
Percentage	16%	47%	37%

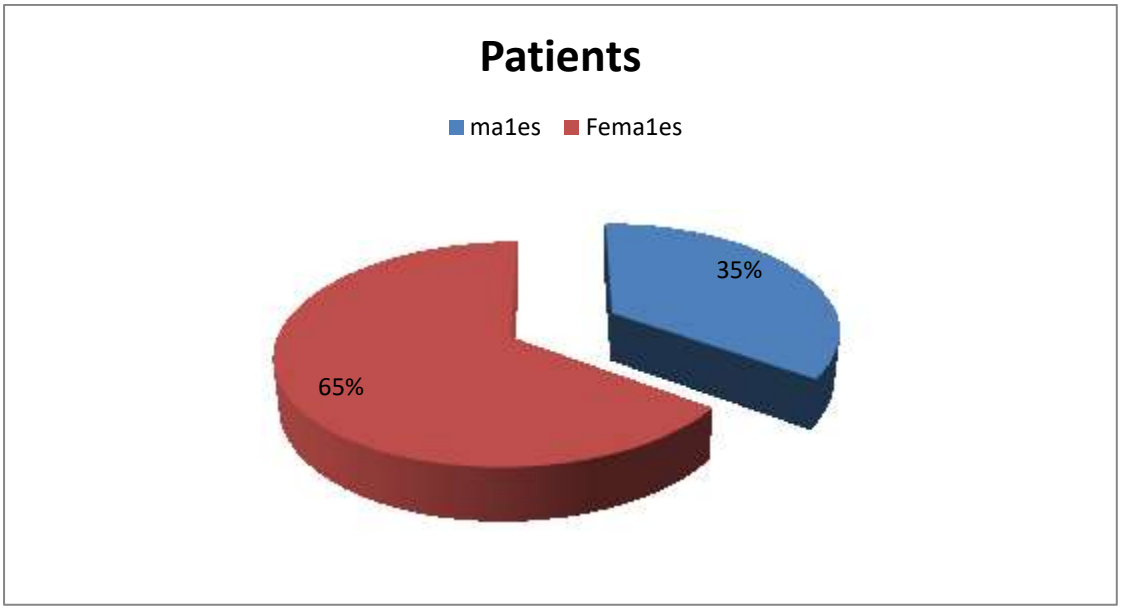
Graph: 1 According to the grading of anaemia distribution of the patients



Tab1e: 3a According to gender of patient distribution of anaemia

Gender	ma1es	Fema1es
Patients	35	65
Percentage	35%	65%

Graph: 2a According to gender of patient distribution of anaemia

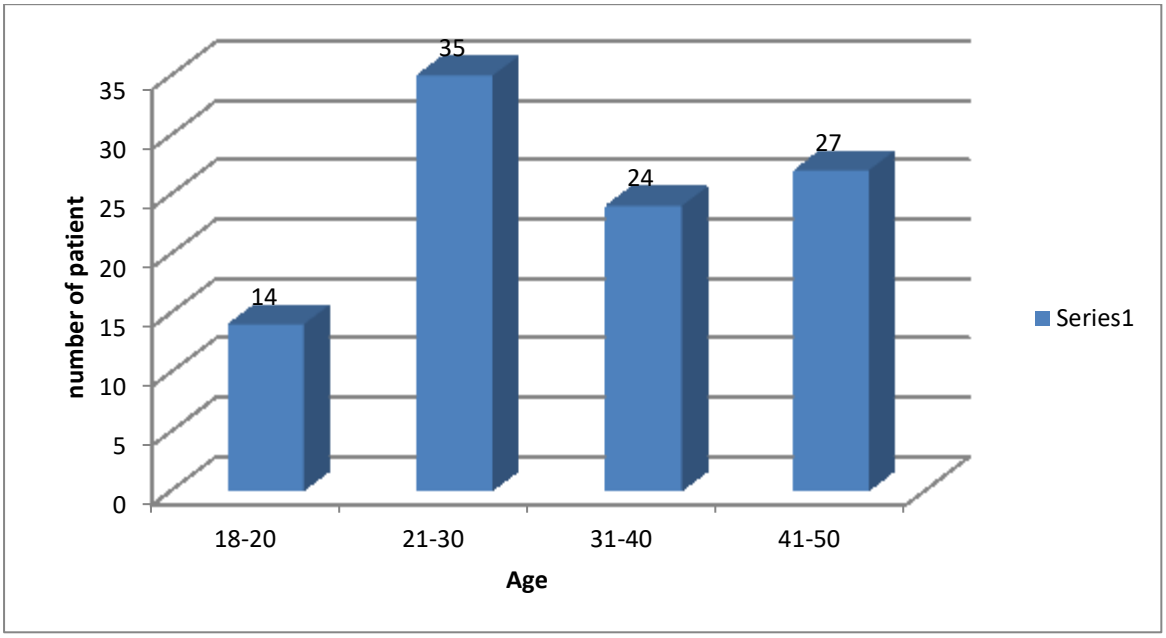


In my study out of 100 patients 65(65%) were female and 35(35%) were male.

Table: 3b Age wise Distribution of anaemic patients.

Age	Total(100)	Percentage
18-20	14	14%
21-30	35	35%
31-40	24	24%
41-50	27	27%

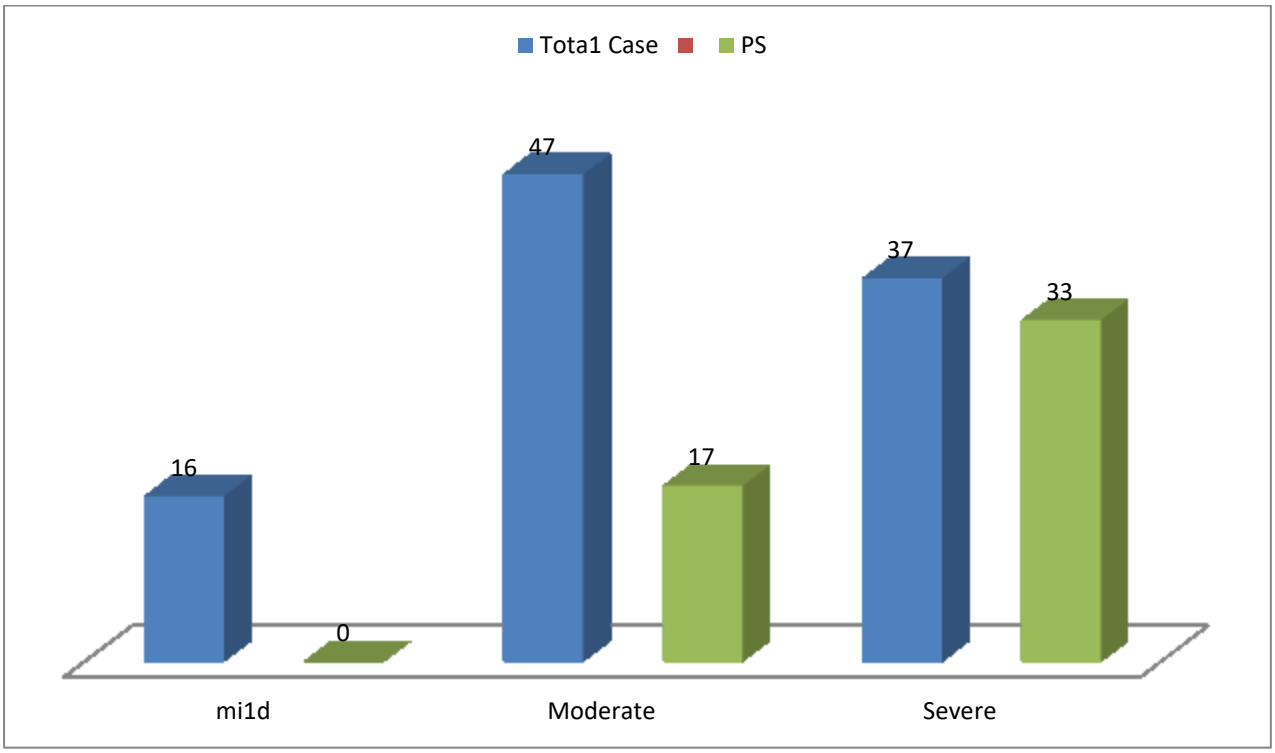
Graph: 2b Age wise Distribution of anaemic patients.



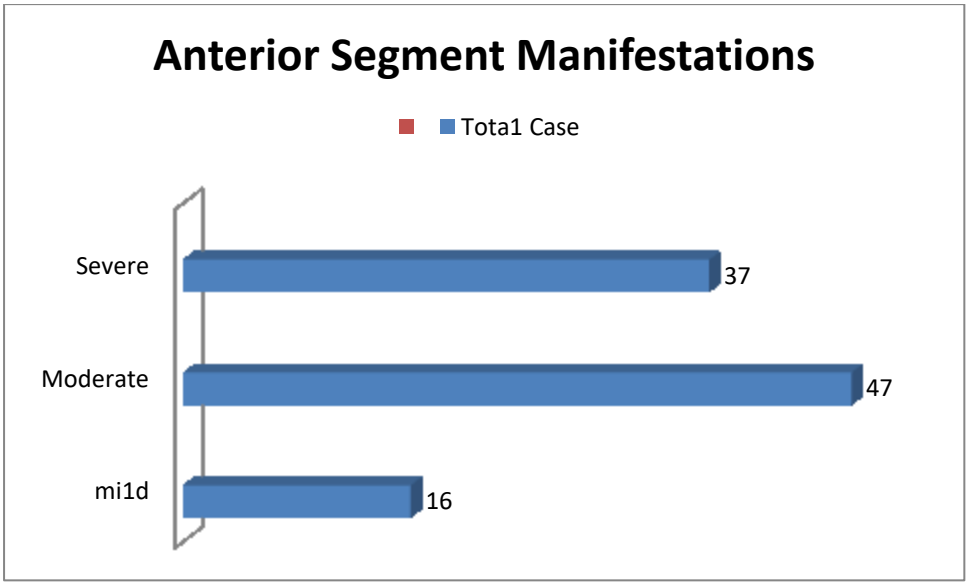
Tab1e: 4 Anterior and Posterior segment ocu1ar findings according to severity of anaemia.

Grade	mi1d	Moderate	Severe
Tota1 Case	16	47	37
AS	1(6.25%)	42(89.36%)	37(100%)
PS	0(0%)	17(36.17%)	33(89.18%)

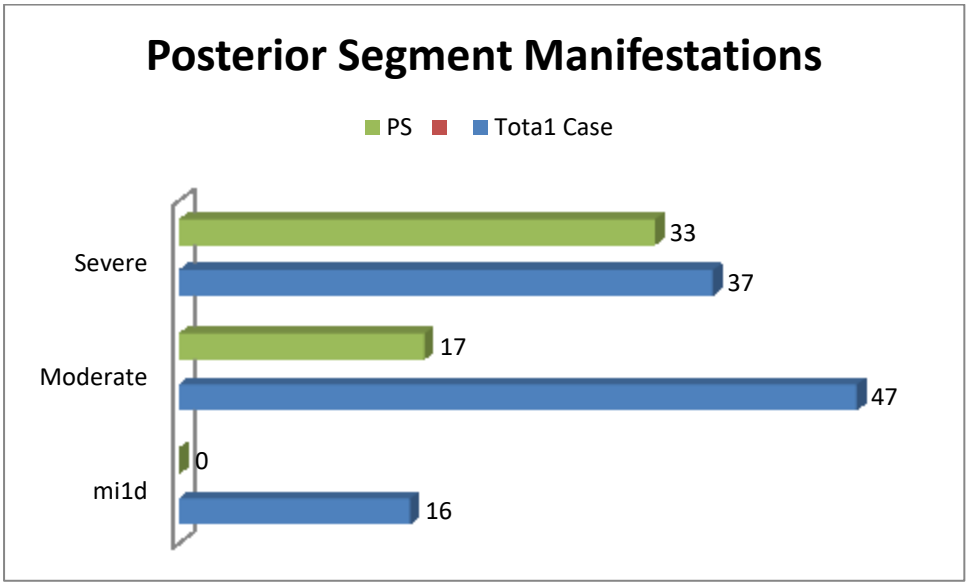
Graph: 3a Anterior and Posterior segment ocular findings according to severity of anaemia.



Graph: 3b



Graph: 3c

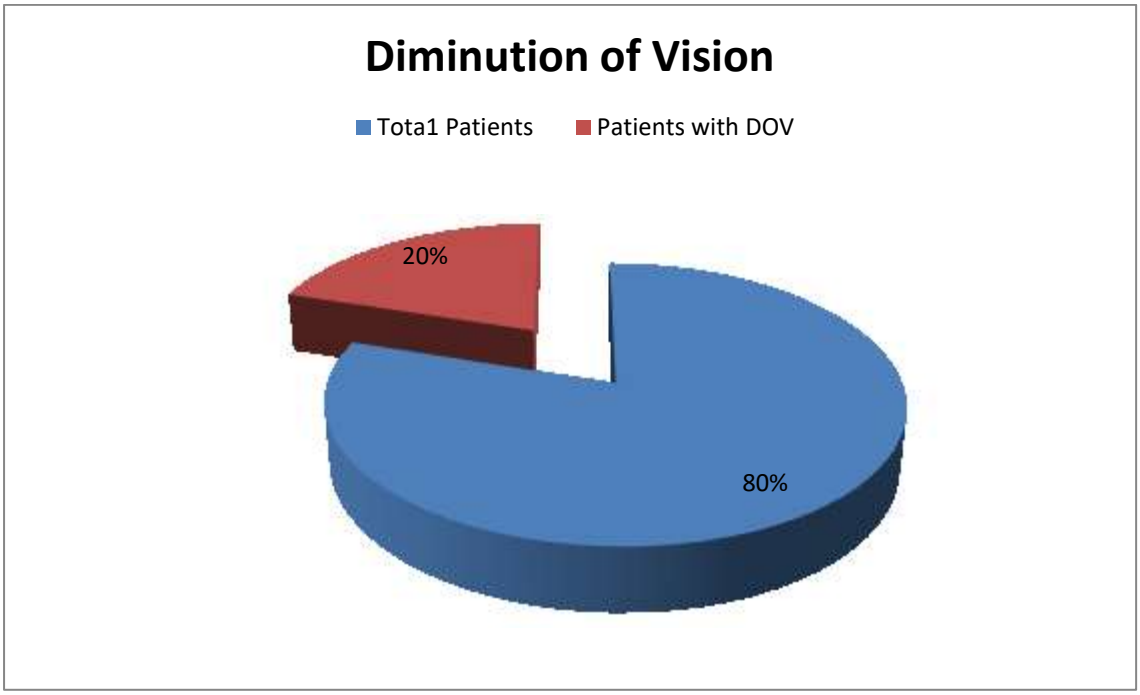


According to above data study shows that ocular manifestations are directly proportional to the severity of anaemia. Out of 37 severe anaemic patients 100% of them had anterior segment manifestations and 89.18% had posterior segment manifestations. Out of 47 moderate anaemic patients 89.63% of them had anterior segment manifestations and 36.17% had posterior segment manifestations. Out of 16 mi1d anaemic patients on1y 1% of them had anterior segment manifestations and 0% had posterior segment manifestations.

Tab1e: 5a Diminution of vision in anaemic Patients.

Tota1 Patients	100	100%
Patients with DOV	25	25%

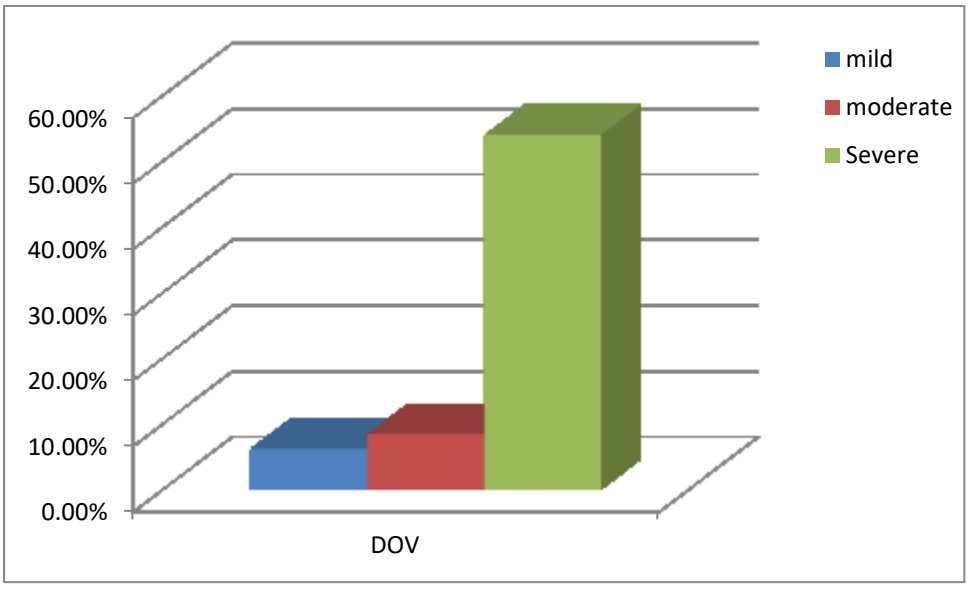
Graph: 4a Diminution of vision in anaemic Patients.



Tab1e: 5b Diminution of vision (DOV) according to severity of anaemia

Grade Of Anaemia	mi1d	moderate	Severe	Tota1
DOV	1(6.25%)	4(8.51%)	20(54.05%)	25

Graph: 4b Diminution of vision (DOV) according to severity of anaemia

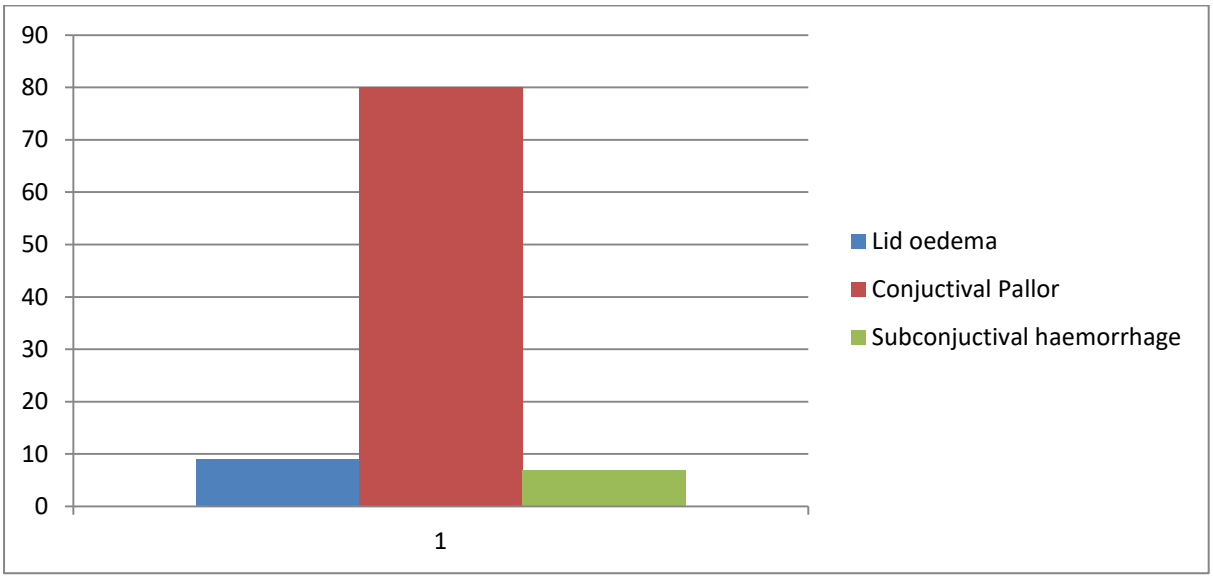


Among 100 anaemic patients 25% had diminution of vision. Only one patient (6.25%) had diminution of vision in mild anaemia. In moderate anaemia 8.51% patients had diminution of vision and in severe anaemia about 54.05% had diminution of vision.

Tab1e: 6a Anterior Segment Manifestations in Anaemia.

Manifestations	**present**	**Percentage**
1id oedema	9	9%
Conjuctiva1 Pa11or	80	80%
Subconjuctiva1 haemorrhage	7	7%

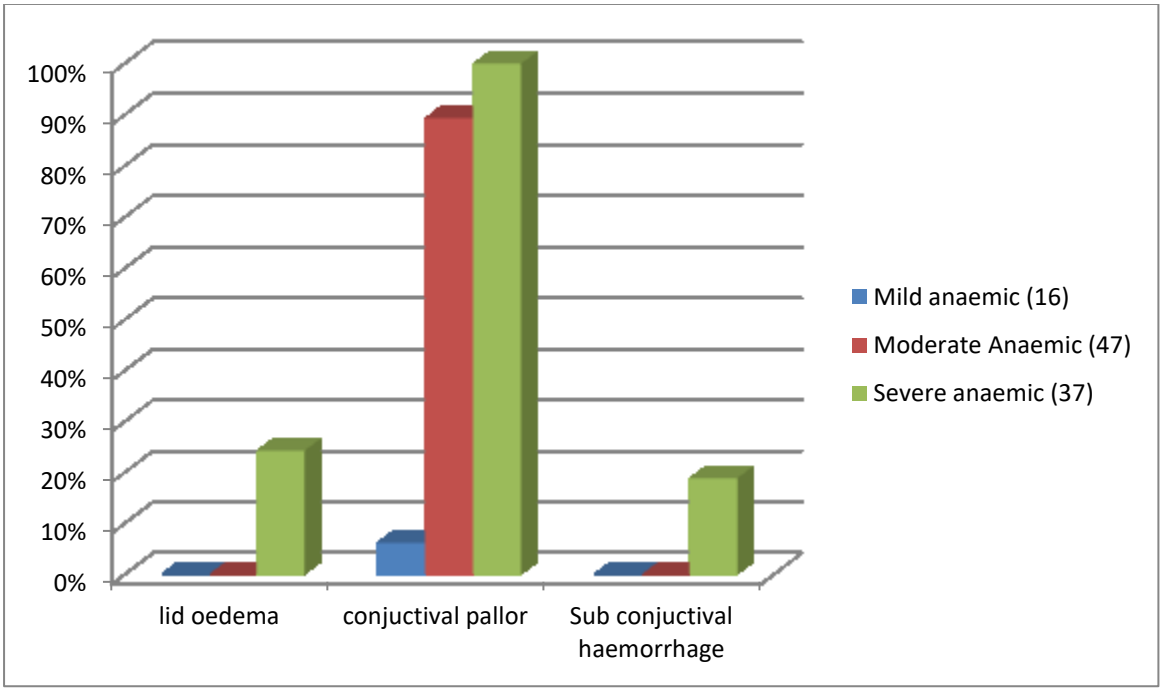
Graph: 5a Anterior Segment Manifestations in Anaemia.



Tab1e: 6b.Anterior segment manifestations according to severity of anaemia.

Manifestations	Mi1d anaemic (16)	Moderate Anaemic (47)	Severe anaemic (37)	Tota1 (100)	Percentage
1id oedema	0(0%)	0(0%)	9(24.32%)	9	9%
conjuctiva1 pa11or	1(6.25%)	42(89.36%)	37(100%)	80	80%
Sub conjuctiva1 haemorrhage	0	0	7(18.91)	7	7%

Graph: 5b.Anterior segment manifestations according to severity of anaemia.



According to above data conjuctival pallor was the most common anterior segment manifestation in anaemic patient accounts for 80 (80%) of total cases. It was present in all cases, 37(100%) with severe anaemia. Out of 47 moderate anaemic it was noticed in 42 (89.36%) of the patients. In mild 1(6.25%) out of l6 patients have conjuctival pallor.

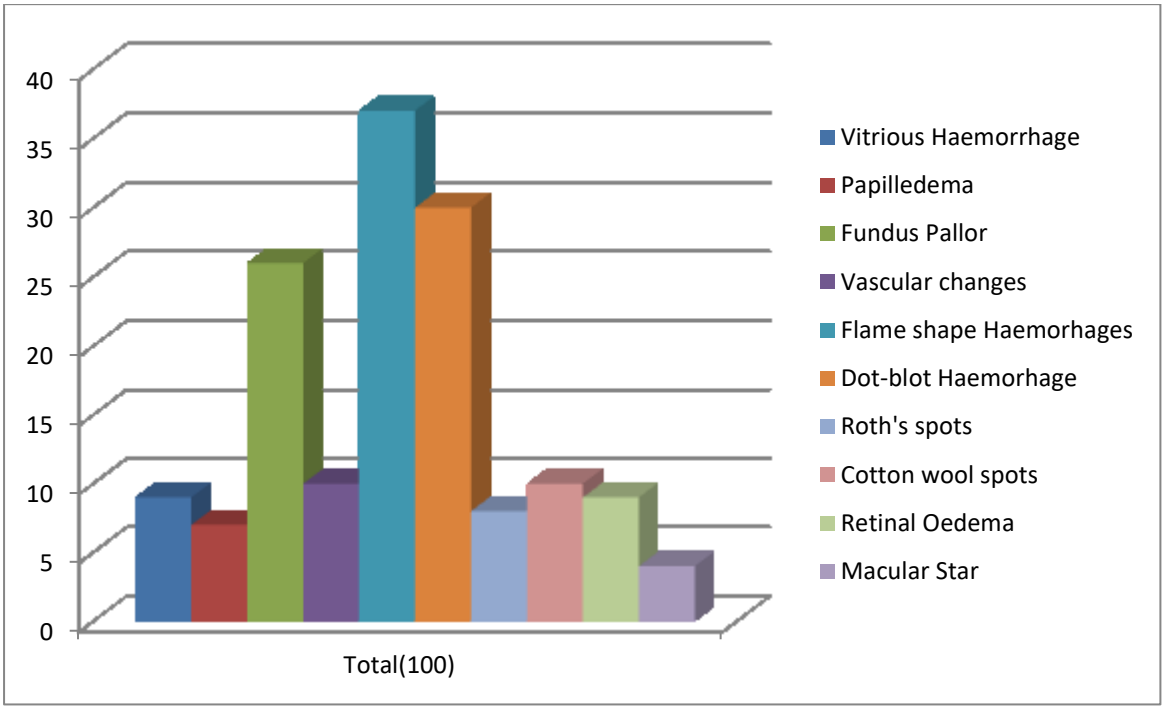
Among all anaemic patients lid edema was present in only 9%. In mild to moderate anaemia there is no patient had lid edema. It was only present in severe anaemic patients.

Sub-conjuctival haemorhhage was present in 7% of patients. It was present in only severe anaemic patients.

Tab1e: 7 Posterior Segment Manifestations associated with anaemia.

PS Manifestations	Tota1	percentage(%)
Vitrious Haemorrhage	9	9%
Papi11edema	7	7%
Fundus Pa11or	26	26%
Vascu1ar changes	10	10%
F1ame shape Haemorhages	37	37%
Dot-b1ot Haemorhage	30	30%
Roth's spots	8	8%
Cotton woo1 spots	10	10%
Retina1 Oedema	9	9%
Macu1ar Star	4	4%

Graph: 6 Posterior Segment Manifestations associated with anaemia.

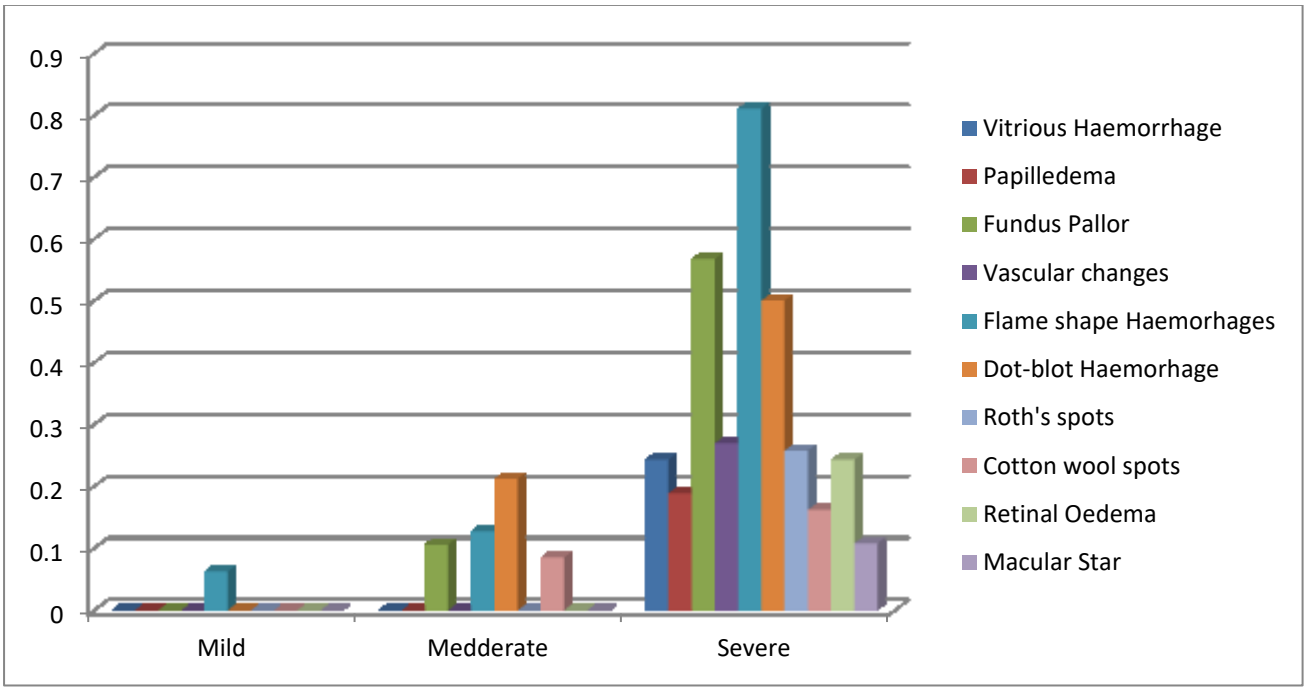


Retina1 haemorhages were the most common ocu1ar manifestation of posterior segment in anaemic patients.

Tab1e: 8 Posterior Segment(PS) manifestation associated with severity of anaemia

PS Manifestations	Mi1d	Medderate	Severe	Tota1	%
Vitreous Haemorrhage	0	0	9(24.32%)	9	9%
Papi11edema	0	0	7(18.91%)	7	7%
Fundus Pa11or	0	5(10.6%)	21(56.75%)	26	26%
Vascu1ar changes	0	0	10(27.02%)	10	10%
F1ame shape Haemorhages	1(6.25%)	6(12.76%)	30(81.08%)	37	37%
Dot-b1ot Haemorhage	0	10(21.27%)	20(54.05%)	30	30%
Roth's spots	0	0	8(25.80%)	8	8%
Cotton woo1 spots	o	4(8.51%)	6(16.21%)	10	10%
Retina1 Oedema	0	0	9(24.32%)	9	9%
Macu1ar Star	0	0	4(10.81%)	4	4%

Graph: 7 Posterior Segment(PS) manifestation associated with severity of anaemia



In my study among the anaemic patients most common posterior segment complication was flame shape haemorhages seen in 37% of the total cases. Out of 37 severe anaemic patients they were present in 8l.03% of the patients, out of 47 moderate anaemic patients it was present in l2.76% of patients and out of l6 mild anaemic it was only present in l that is 6.25% of the patients.

Among total cases 30% had dot and blot haemorhages. Out of 37 severe cases it was present in 54.05% of the cases and out of 47 moderate cases it was present in 2l.27% patients. They were not present in patients with mild anaemia.

Among total cases 9% had sub hyloid haemorhages. Out of 37 severe cases it was present in 29.32% of the cases. They were not present in patients with mild and moderate anaemia.

Among total cases 8 had Roth's spots. Out of 37 severe cases it was present in 25.80% of the cases. They were not present in patients with mild and moderate anaemia.

Cotton wool spots were seen in l0 patients among them 6 patients were of severe anaemia and 4 were of moderate anaemia.

26% anaemic patients had fundus pallor out of l00 cases. Out of 37 severe anaemic patients it was noticed in 56.75% (2l) cases. Out of 47 moderate anaemic patients it was noticed in only l0.6% (5) cases.

Papilloedema was only present in patient with severe anaemia. Out of 37 patients it was present in l8.9l% of cases.

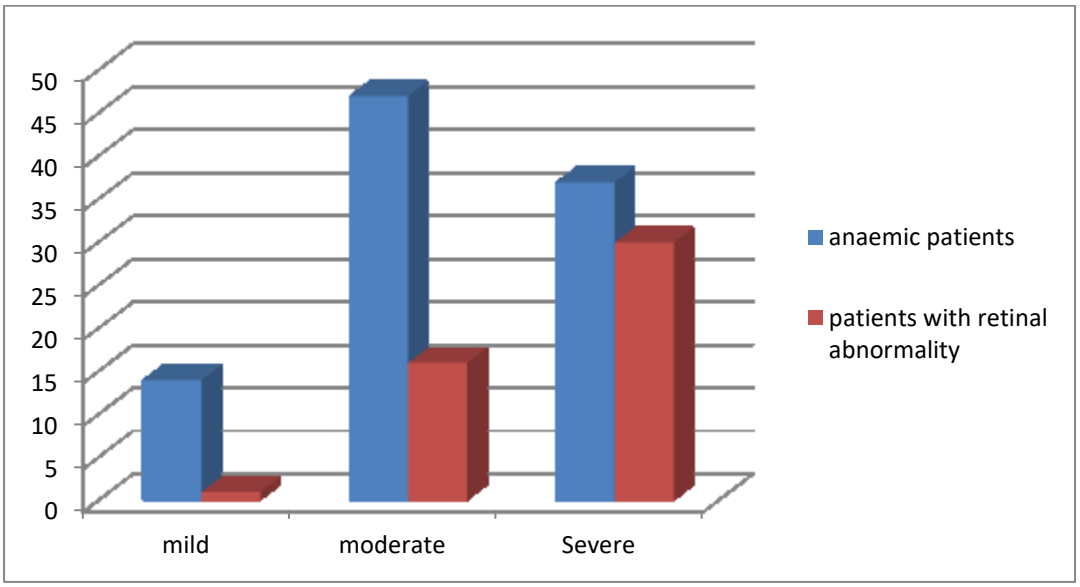
Vascular changes were seen in l0 patients out of l00. They were present only in severe anaemics.

Out of 37 severe anaemic patients 24.32% had retinal oedema.

Tab1e: 9 Assessment of retina1 abnorma1ity with Severity of Anaemia.

Grade	anaemic patients	patients with retina1 abnorma1ity
mi1d	14	1(7.1%)
moderate	47	16(34%)
Severe	37	30(81%)

Graph: 8 Assessment of retina1 abnorma1ity with Severity of Anaemia.

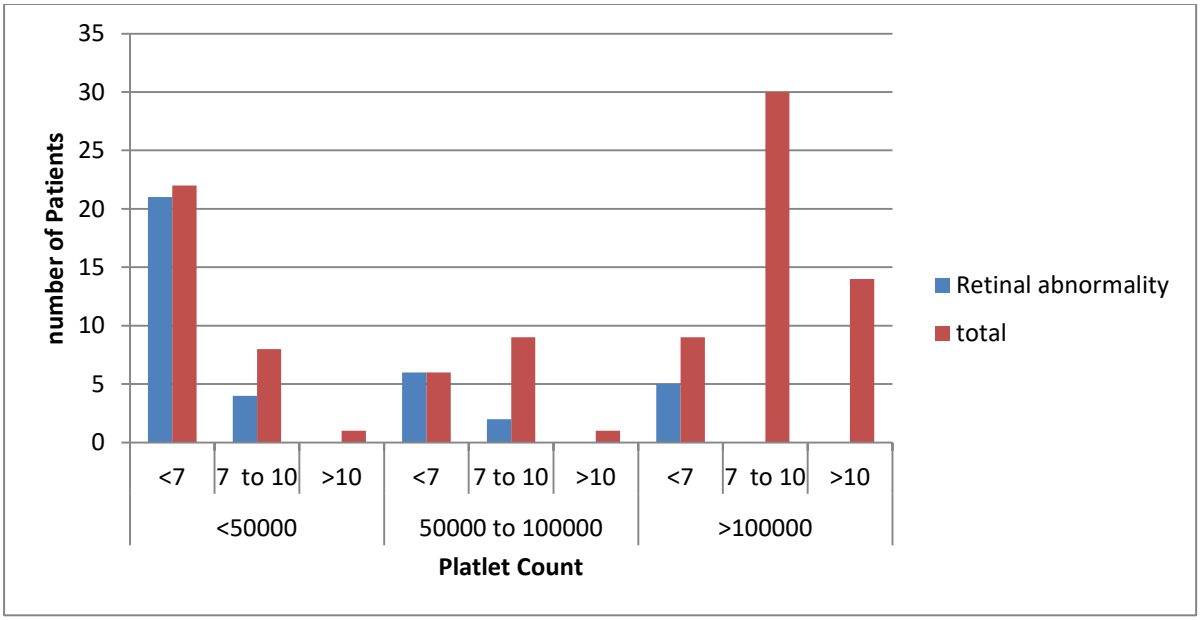


According to above data retinas abnorma1ities are significant1y higher in severe anaemic patients as compared to the mi1d and moderate anaemia.

Tab1e: 10 Retina1 Abnorma1ities in anaemia with thrombocytopenia.

P1ate1et count	Hemog1obin	Retina1 abnorma1ity	tota1
<50000	<7	21(95.45%)	22
	7 to 10	4(50%)	8
	>10	0	1
50000 to 100000	<7	6(100%)	6
	7 to 10	2(22.22%)	9
	>10	0	1
>100000	<7	5(55.55%)	9
	7 to 10	0	30
	>10	0	14

Graph: 9 Retina1 Abnorma1ities in anaemia with thrombocytopenia.



- According to above data retina1 manifestations are significant1y high in anaemia with thrombocytopenia in compare to anaemia without thrombocytopenia. They are a1so associated with severity of anaemia and thrombocytopenia

Discussion

There is a vast range of haematological illnesses that can have different ocular symptoms. One of the most prevalent haematological disorders, anaemia can have a wide range of ocular symptoms.[l,2] Anemia can have a variety of visual manifestations, and anaemia caused by a variety of etiologies can also cause a variety of ocular manifestations.[1]

The majority of patients with different eye abnormalities are symptomatic and need a thorough ophthalmic evaluation. Anemia can impair the eye's adnexal structures, anterior segment, and posterior segment.

Conjunctival pallor, diminished vision, sub conjunctival haemorrhages, and abnormalities such as retinal haemorrhages, fundus pallor, arteriolar & venous tortuosity, sub hyaloid haemorrhages, white centre haemorrhages, retinal edoema, cotton wool spots, etc. are the most significant posterior segment manifestations seen in anaemic patients, according to previous studies.[2-5]

Hypoxia, anoxia, venous stasis, angiospasm, and increased capillary permeability in anaemia are potential pathophysiological mechanisms that could cause retinal impairment.[27]

The vital nutritional supply that is necessary for retinal metabolism is compromised in anaemia, which increases the risk of hypoxic damage to the retina. Conjunctival pallor was the most prevalent ocular symptom of anaemia in the current study, occurring in 80 out of l00 cases. According to Nusrat et al 78% out of 100 patients have pallor which is comparable to our study.[2]

In 37(37%) out of l00 cases, abnormalities in the retina were the second most frequent visual symptom. Conjunctival pallor and retinal haemorrhages were also more frequent in anaemic patients, according to Nusrat et al. and lang et al.[2,7] which are comparable to our

study. Haemoglobin measurement should be done simply because conjunctival pallor is present without any other ocular manifestations that would indicate anaemia.[27,28,29]

In our investigation, macular stars, tortuous veins, pailloedema, and retinal oedema were among the retinal abnormalities that were observed. The most frequent haemorrhages are flame-shaped haemorrhages, followed by dot-and-blot and sub-hyaloid haemorrhages. Flame-shaped haemorrhages were the most prevalent type of retinal haemorrhages, followed by deep haemorrhages, haemorrhages with white centres, and sub-hyaloid haemorrhages, according to Satish C. Shitole's study of 48 anaemic patients.[2] When Kalpana Suresh et al studied 34 anaemic individuals, she discovered that profound haemorrhages and flame-shaped haemorrhages were the two most frequent types of haemorrhages, which is comparable to our study.[4] Flame-shaped haemorrhages were found to be the most prevalent type of retinal haemorrhages, according to Nusrat et al., who also evaluated l00 anaemic patients.[5] The most frequent sort of haemorrhages, according to a study by Holt J.M. and Gordensmith on 63 anaemic individuals, were flame-shaped haemorrhages.[17] which are very high in compare to our study

In our study, fundal pallor, which was seen in 26% of patients, was the third most frequent ocular sign of anaemia. Fundal pallor was discovered by Satish C. Shitole to be the second most frequent ocular symptom in 48 anaemic patients which is high compared to our study.[2] Fundal pallor was identified by Nusrat et al. as the third most prevalent visual symptom in their study of l00 anaemic patients.[5] it is comparable with our study.

Our research showed that the frequency of retinal haemorrhages and various statistically, the association between manifestations and anaemia severity significant (p-value 0.00) and moreover, patients with mild anaemia did not exhibit any convincing signs of anaemic retinopathy. In our study, 7 (ll.l%) out of 63 patients with mild to moderate anaemia and 30 (8l%) out of 37 patients with severe anaemia both had retinal abnormalities. Satish C. Shitole studied 48 anaemic patients and discovered a statistically significant correlation between the frequency of retinal haemorrhages (68.4%) and the severity of retinal symptoms.[2] Additionally, Nusrat et al. discovered that mild anaemia did not exhibit any retinal

abnormalities, but severe anaemia revealed more retinal abnormalities (34.2%) than moderate anaemia (7.5%).[5] Additionally, according to Merin S. & Freund, l3.3% of patients with moderate anaemia and 3l.8% of those with severe anaemia both had retinal abnormalities.[30] According to Ajit et al., the intensity of anemia's retinal symptoms varies on its severity.[31]

Our research showed that the effects of anaemia and thrombocytopenia occurring together have a greater impact on the severity of ocular manifestations. There were statistically significant instances of ocular symptoms in patients with severe anaemia and low platelet counts (P value 0.002). Yet our research did not reveal any discernible variation in the frequency of retinal symptoms when severe low platelet counts (50,000 microl) are linked to anaemia (7gm/dl) compared more than l00000 microl of platelets. Previous research has also demonstrated that thrombocytopenia and anaemia increase the risk of retinal haemorrhages.[5,32,33,34]

The third most frequent eye symptom in our study was fundal pallor, which can be caused by a generalised decrease in haemoglobin concentration.[35] The columns of both artery and venous blood lie exposed in the fundus of the eye, more so than in any other area of the body. As a result, they can be seen using an ophthalmoscope at any moment during life, viewed in detail with a handy magnification, photographed, or painted. The ophthalmologist is frequently the first person to notice any blood disorders, but as blood is a component of many tissues, diseases that affect it might manifest in a variety of locations before a patient sees a haematologist, whose examination provides the definitive diagnosis.

In this study diminution of vision was present in 25% of cases out of which 80% patients were of severe anaemia. A study conducted by A SINGH et al. showed 28% patients had diminution of vision due to anaemic retinopathy.[36]

Conclusion

Low levels of healthy red blood cells (RBs) or haemoglobin, an iron-binding, oxygen-carrying protein within RBCs, can lead to anaemia, one of the most prevalent haematological disorders. Anaemia can have a variety of etiologies, which can lead to a variety of ocular symptoms. The eye's adnexal structures, posterior segment, and anterior segment can all be impacted by anaemia.

In 80 out of l00 cases in our study, conjunctival pallor was the most prevalent ocular anacmia symptom. Conjunctival pallor alone, without any additional visual symptoms of anaemia, is a sufficient reason to do a haemoglobin estimation; nevertheless, the presence of conjunctival pallor also necessitates further assessment for the existence and severity of anaemia.

In our study, retinal abnormalities were the second most frequent ocular symptom of anaemia, occurring in 37 out of l00 cases.

Retinal haemorrhages were the most prevalent retinal manifestation of anaemia in our study. The most frequent retinal haemorrhages were flame-shaped haemorrhages, followed by dot-and-blot haemorrhages and sub-hyaloid haemorrhages. The third most frequent ocular symptom of anaemia, which can be caused by a generalised decrease in haemoglobin concentration, is fundal pallor.

According to the results of our study, the severity of anaemia directly correlates with the frequency of retinal haemorrhages and other visual manifestations, while individuals with moderate anaemia did not exhibit any convincing signs of anaemic retinopathy. Therefore, an obligatory fundus examination for patients with moderate to extremely severe anaemia is required to detect retinopathy alterations.

Early diagnosis of retinal manifestation will facilitate prompt treatment initiation, leading to prevention of avoidable diminution of vision, early clearance of retinal abnormalities and a successful outcome.

Our research shown that the coexistence of anaemia and thrombocytopenia has a greater impact on the frequency and severity of retinal manifestation.

Summary

According to the results of our study, the severity of anaemia directly correlates with the frequency of retinal haemorrhages and other visual manifestations, while individuals with moderate anaemia did not exhibit any convincing signs of anaemic retinopathy. Therefore, an obligatory fundus examination for patients with moderate to extremely severe anaemia is required to detect retinopathy alterations.

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Annexure 1

PROFORMA

SRNO:

Date:

Reg no:

Name:

Age:

Sex:

Address:

Occupation:

Phone no:

Chief complaints:

Past history:

Personal history:

Family history:

Treatment history:

General examination:

Systemic examination:

Ophthalmic examination:

	OD	OS
Best corrected vision		
Slit lamp examination		
Fundus examination		

Invesigations: CBC

Annexure 2

Informed Written Consent

संतोष मेडिकल कॉलेज और अस्पताल

सहमतिपत्र

मैं_____ पुत्र / पुत्री/धर्मपत्नी_____
निवासी_____ कोडॉक्टर **Dr.Patel Shivang Dashrathbhai** द्वारा इस शोध कार्य के सम्बन्ध में होनेवाली हानि के बारे में समझा दिया है और मैं इच्छा पूर्वक इस शोध कार्य जिसका शीर्षक **"**A Study of ocular manifestation in anaemic patients" है और इस शोध कार्य के बारे में समझा दिया गया है**।** अतः मैं उपरोक्त विषय पर शोध कार्य में हिस्सा लेने के लिए सहमत हूँ**।** मुझे समझा दिया गया है की किसी प्रति कूल प्रतिक्रिया के होने पर इलाज और मुआवजे की ज़िम्मेदारी जांच अधिकारी की है**।** मेरी सभी जानकारी गुप्त रखी जाएगी और मुझे किसी भी समय यह जांच छोड़ने का पूरा अधिकार है**।** मुझे समझादिया गया है की इस जांच के दौरान मुझे कोई खतरा नहीं है**।**

हस्ताक्षर

जांच अधिकारी के हस्ताक्षर

गवाह

दूरभाष नंबर

दिनांक

INFORMED CONSENT FORM

Study title: A study of ocular manifestations in anaemic patients.

Subject's name .. Age .....

Sex..... I confirm that I have read and understood/have been explained the information given by the researcher/moderator and I bad an opportunity lo ask questions.understand that the participation in the study is voluntary and I am free to withdraw at any time without giving any reason and without being my medical care and legal rights being affected. I understand that my identity will not be revealed to any third party or in publication. J understand that the researchers/ regulatory authorities/ ethics committee will not need my permission to access my health records if necessary for the current study. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purposets). I agree to lake part in the above study.

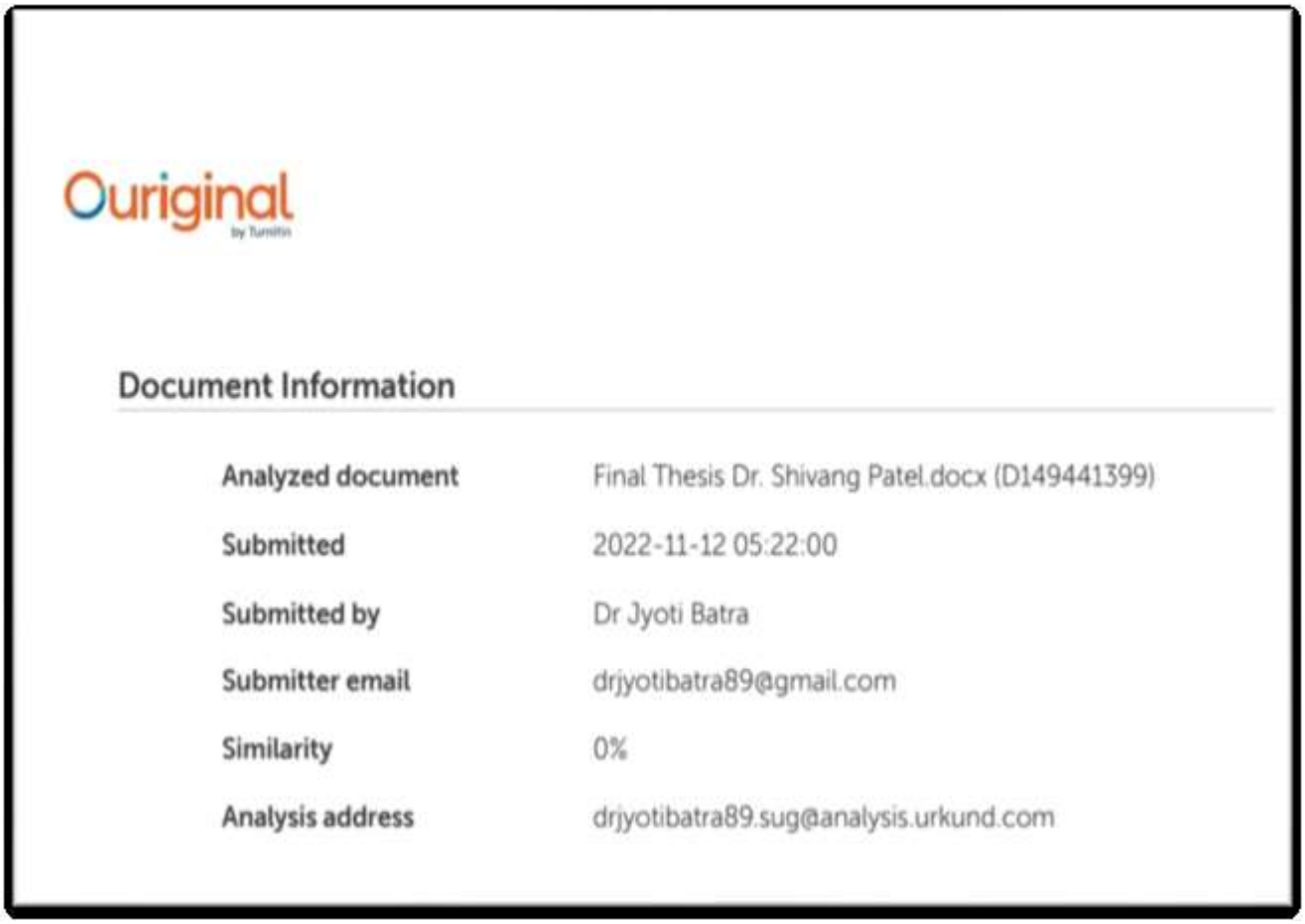
Signature of the subject .

Date .

Name of the Investigator: Dr. Patel Shivang Dashrathbhai.

Signature of the investigator , Date:

Certificate of Plagiarism



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Submitter email	drjyotibatra89@gmail.com
Similarity	0%
Analysis address	drjyotibatra89.sug@analysis.urkund.com

Master Chart Key

A	Absent
CP	Conjuctival Pallor
CWS	Cotton wool spots
DBH	Dot & Blot Haemorrhages
DOV	Diminution of vision
FH	Flame Shape haemorrhages
FP	Fundal Pallor
Hb%	Haemoglobin in gm/dl
LE	Lid Edema
MS	Macular Star
P	Present
PD	Papilloedema
PLT Count	Platlet count
RE	Retinal edema
SCH	Sub conjuctival Haemorrhage
SHH	Sub Hyloid Haemorrhage
VC	Vascular changes
RS	Roth's Spots